DOCUMENT RESUME

ED 414 759 FL 024 957

TITLE	Sunflower/Girasol: Spanish/English Elementary School Science Activity Curriculum. Evaluation of the Educational Efficacy of the Plant and Water Units.
INSTITUTION	Intercultural Center for Research in Education, Arlington, MA.
SPONS AGENCY	National Science Foundation, Arlington, VA.
PUB DATE	1997-07-00
NOTE	8p.
PUB TYPE	Reports - Evaluative (142)
EDRS PRICE	MF01/PC01 Plus Postage.
DESCRIPTORS	*Bilingual Education Programs; Elementary Education; English; Hispanic Americans; Instructional Effectiveness; *Plants (Botany); Program Descriptions; Program Effectiveness; *Science Education; Science Instruction; *Spanish; Spanish Speaking
IDENTIFIERS	Hispanic American Students

ABSTRACT

The Sunflower/Girasol program is a Spanish/English bilingual science discovery program for Hispanic children in grades 2-6, designed to improve science instruction and educational opportunity for this group. The report describes the program's proposed activities and products, progress to date, and results of an evaluation of the first two units of the curriculum, on plants and water. The units were field tested in 1996 in 120 bilingual and mainstream grade 1-5 classrooms in six states and Puerto Rico. Results indicate enthusiasm on the part of teachers, and increased student interest and motivation. Most of the participating teachers had no training in use of the materials but found the activities easy to implement. A year later, a more controlled evaluation was conducted in four schools, in grades 3 and 4, with control groups using commercially available curricula. Results of this second evaluation were found to support the efficacy of the Sunflower/Girasol science curriculum model. (MSE)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED 414 759

Sunflower/*Girasol*

Spanish/English Elementary School Science Activity Curriculum

Evaluation of the Educational Efficacy of the Plant and Water Units

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)
This document has been reproduced as received from the person or organization originating it.
☐ Minor changes have been made to improve reproduction quality.
• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

Summary Report

PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL HAS BEEN GRANTED BY
Dr. John Zuman
TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

July 1997

Intercultural Center for Research in Education (INCRE)
366 Massachusetts Avenue
Arlington MA 02174
Tel. (617) 643-2142; e-mail icre@igc.apc.org

The Sunflower/*Girasol* project is supported, in part, by a grant from the National Science Foundation.

F L024957

BEST COPY AVAILABLE

I. Introduction

In order to address continuing under-representation of Latino children in mathematics and science courses, continuing discrepancies in achievement, persistent lack of opportunity for high quality innovative study of technical subjects in predominantly minority schools, and a pervasive lack of Latino youth who choose careers in the sciences, in 1994 the Intercultural Center for Research in Education (INCRE) presented to the National Science Foundation a proposal to initiate Sunflower/*Girasol*, a bilingual science discovery curriculum for Latino children in grades 2 to 6.

The INCRE proposal promised a colorful curriculum in a magazine format that would invite children to engage in science activities and to carry out investigations in their schools and neighborhoods. The curriculum would present science information in stimulating graphic formats and pose interesting and relevant questions for children based on current scientific developments. All activities would be pedagogically sound, classroom activities and experiments would be included in each issue and the process-oriented curriculum and instructional approach would be fully aligned with the National Science Education Standards (NSES).

The fully bilingual Spanish/English format would encourage Latino students to develop language skills and at the same time turn their interest to the world of scientific discovery. Teachers working with Latino students in mainstream, bilingual and ESL settings would be able to utilize the curriculum contents in planning and conducting science activities, and English speaking students in two-way bilingual programs and Spanish as a foreign language classes would be able to use the materials to enhance their Spanish language skills. Activities would be structured to invite active parental participation.

The curriculum would encourage children to observe and investigate phenomena in their environment. Each issue of Sunflower/*Girasol* would contain activities in the area of "urban science" that would draw on the experiences of city residents, as well as presenting perspectives from the world of nature. Children would be invited to share their data, writing and art work for publication.

Sunflower/*Girasol* would strive to foster a multicultural perspective by presenting science and technology issues faced by communities in various stages of economic development and in this way strengthen Latino children's identification with their national origin and ethnic heritage. Children would be encouraged to gather information from their parents and relatives about conditions of life in their countries of origin, thus enhancing parental participation in their children's investigations, promoting interest in native culture, and validating Latin American

cultural approaches to scientific problem solving. The curriculum would also highlight historical and contemporary contributions and accomplishments of female and male Latino scientists in order to promote positive role models for children of Hispanic descent.

The National Science Foundation Directorate for Education and Human Resources Division of Materials Development funded the initial phase of the Sunflower/*Girasol* project, which began in April 1995. The goal of the first phase was to develop the first two units of the curriculum and conduct a nationwide field test in order to assess student and teacher response to the materials. Results of the initial phase were to inform the decision to support a second phase of the project.

II. Progress to Date

From April 1995 to February 1996, INCRE developed and produced the first two modules of Sunflower/*Girasol*, the first on Plants and the second on Water. The Plant unit was geared toward the lower end of the target population, around grades 2 to 3 and the Water Unit slightly higher with a focus on grades 3 to 4. In order to familiarize the reader with the format of the curriculum, a sample of one copy of a student activity book (in English) is attached in Appendix A.

In the Spring of 1996, the Plant and Water units were field tested in 120 bilingual and mainstream classrooms by nearly 3,000 students in grades 1 to 5 in California, Texas, New Mexico, Florida, New York, Massachusetts and Puerto Rico. We chose to field test the materials within a wide age range in order to assess the appeal and educational impact of the curriculum for younger and older students. The materials were field tested with in classrooms with Mexican, Central American, and Caribbean students in order to assess their effectiveness among different Latino groups.

Evaluation results from the 120 field sites were most favorable. We received extensive feedback from teachers on the quality, content, presentation and organization of the curriculum. Teachers reported a significant increase in student interest and motivation generated by the use of Sunflower/*Girasol*. Significantly, none of the participating teachers received training in use of the materials, yet nearly all reported having no trouble in implementing the variety of curriculum activities. The overwhelming majority of teachers reported that students were engaged in the experiments, that the activities were at an appropriate age level, that they appealed to both boys and girls, and that the parental involvement activities were successful. Some teachers requested additional detail in the teacher's guides, particularly with respect to activities that involved data collection and graphing. More than 80% said that they would purchase the materials once they became commercially available.

Given the very positive response from the formative evaluation, quantitative evidence for the educational efficacy of the Sunflower/*Girasol* modules was needed. In the Fall of 1996 INCRE organized a controlled study to assess the effectiveness of the first two units of the curriculum in promoting science content learning and acquisition of science process skills. The following section outlines the methodology and results of the outcome evaluation study.

III. Outcome Evaluation Study

A. Methodology

A controlled outcome evaluation that focused on what students learn when they use Sunflower/ *Girasol* was conducted during the Spring of 1997. Four schools and a total of 268 students participated in a quasi-experimental evaluation study. In each participating school, one third grade class used the Sunflower/*Girasol* Plants Unit, and one fourth grade class used the Water Unit. The student population was quite diverse in each school and children from Mexico, Puerto Rico, El Salvador, Guatemala, Cuba, Dominican Republic, Nicaragua, Honduras, Colombia, Bolivia and Venezuela were represented.

Comparison groups for each grade in the same schools used commercially available curricula to teach the same topics. For the Plant Unit, the comparison classes used Science Horizons (Silver Burdett & Ginn, 1993). For the Water unit, comparison groups used HBJ Science- Level 4 (Harcourt/ Brace/Jovanovich, 1985) or Science - Level 4 (Scott Foresman Science, 1993). The treatment and comparison classes were randomly assigned, thus controlling for the possibility that the more experienced or more motivated teachers at each school site select the Sunflower/*Girasol* materials.

Pretests were administered the same day to the treatment and comparison classes just prior to initiating the units. Post-tests were administered to the treatment and comparison groups after completing instruction. Tests at three of the four sites were administered by an INCRE evaluator; the tests at one site were teacher-administered.

Participating teachers did not receive any special training in use of the Sunflower/*Girasol* curriculum. They relied completely on information supplied in the Teacher's Guides. The Plant unit took 9 weeks to complete, the Water unit took 5 weeks.

The test instruments used to evaluate students in this study combined multiple choice questions adapted from the CTBS battery and the Third International Mathematics and Science Study

(TIMMS) with performance items consistent with the National Science Education Standards (NSES). The test items assessed student understanding of key science and environmental education concepts (eg: plant germination and growth, sources of food from plants, water consumption and conservation, sources of water pollution, the water cycle) and science process skills (eg: graphical representation and interpretation of data, predicting results of an experiment, measurement).

All test items were validated two times in non-participating schools in order to ensure reliability and content validity of the instruments. The test instruments were prepared both in English and Spanish. The Plants instrument is scored on a scale with a minimum of 0 and maximum of 32 points, and the Water instrument has a maximum of 40 points; scoring is based on a detailed set of rubrics. Students took an average of 30 minutes and a maximum of 45 minutes to complete each test.

A multiple regression analysis was used to determine the efficacy of the Sunflower/*Girasol* treatment. The regression model was specified to predict the gainscore by group, controlling for pretest score and gender. Analysis of variance was utilized to assess if mean gains varied by school.

B. Results of Plant Unit Evaluation Study

The test result means for the Plant Unit evaluation study are shown below (standard deviations are shown in parentheses):

	n	Pretest	Posttest	Mean Gain
Treatment	71	10.2 (4.2)	17.9 (5.8)	7.7 (5.4)
Comparison	75	11.1 (5.1)	15.2 (5.6)	4.1 (5.6)

The effect size of the treatment group controlling for pretest differences was 3.3 points ($F=21.9$, $p<.001$), explaining 23.4% of total variance in the gainscore and representing a substantial mean effect of 0.7 of the pooled standard deviation on the pretest. Gender was not a significant contributor to the regression model.

An ANOVA demonstrated that mean gains were consistent across all participating schools, as shown below:

School	Treatment	Comparison	Difference in mean Gains
New Mexico	5.1	1.1	+ 4.0 p<.01
Massachusetts	9.2	5.8	+ 3.4 p<.01
California	10.4	4.3	+ 6.1 p<.01
Utah	7.7	4.0	+ 3.7 p<.01

The results clearly demonstrate that students who used the Sunflower/*Girasol* Plant Unit increased their knowledge of plant-related concepts and process skills significantly more than students who used a commercial curriculum to study the same topic. The Sunflower/*Girasol* curriculum was equally effective in promoting learning among boys and girls. Gains were consistent across all participating schools, suggesting that teacher, school and background effects can be discounted.

C. Results of Water Unit Evaluation Study

The test results for the Water Unit evaluation study are shown below:

	n	Pretest	Posttest	Mean Gain
Treatment	63	13.6 (6.5)	22.5 (8.3)	8.9 (7.9)
Comparison	59	11.0 (6.4)	14.7 (6.1)	3.7 (5.8)

The effect size of the treatment group controlling for pretest differences was 6.4 points ($F=22.4$, $p<.001$), explaining 27.3% of total variance in the gainscore and representing a very substantial mean effect of 1.0 standard deviation in pretest score. Gender was not a significant contributor to the regression model.

As, with the Plant Unit, an ANOVA of the Water Unit results demonstrated that mean gains were consistent across all participating schools, as shown below:

School	Treatment	Comparison	Difference in mean Gains
New Mexico	10.4	4.1	+ 6.3 p<.01
Massachusetts	8.9	3.7	+ 5.2 p<.01
California	7.4	3.1	+ 4.3 p<.01

The results of the Water Unit evaluation study are very similar to those for the Plant Unit. The results clearly demonstrate that students who used the Sunflower/*Girasol* Water Unit increased their knowledge of water-related concepts and process skills significantly more than students who used a commercial curriculum to study the same topic. The Sunflower/*Girasol* curriculum was equally effective in promoting learning among boys and girls. Gains were consistent across all participating schools, suggesting that teacher, school and background effects can be discounted.

These results provide compelling evidence of the efficacy of the Sunflower/*Girasol* model of science curriculum delivery for Latino elementary school children. Furthermore, the results are fully consistent with the highly positive qualitative assessments of the curriculum made by teachers who have used Sunflower/*Girasol* with their students.